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(54) Ink cartridge for an ink jet printer.

(57) An ink cartridge (20) for an ink jet printer, the ink cartridge (20) having a chamber (C) therein within which is housed an ink bag (1) containing ink, the chamber (C) having absorbent material (4) therein for absorbing waste ink characterised in that a waste ink bag (3) is disposed within the said chamber (C), the waste ink bag (3) containing the said absorbent material (4).

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INK CARTRIDGE FOR AN INK JET PRINTER

The present invention relates to an ink cartridge for an ink jet printer.

As shown in Figure 4, a known ink cartridge 60 for an ink jet printer has a chamber G therein, within which is housed an ink bag 61 containing ink, and a separate chamber H therein within which there is absorbent material 62 for absorbing waste ink. The chamber H, which thus constitutes a waste ink recovery section of the known ink cartridge 60, is located at the top of the latter and is separated by an inner wall 51 from the ink bag housing chamber G.

JP-A-108153/1983 discloses another known construction in which an ink cartridge has an ink bag and porous ink absorbent material for absorbing waste ink which are housed within the same chamber of the same ink cartridge.

However, in the Figure 4 arrangement in which the ink bag housing chamber G is provided separately from the waste ink housing chamber H, it is necessary to ensure that the amount of the absorbent material 62 in the waste ink housing chamber H is sufficient to absorb the whole of the ink within the ink bag 61. As a result, the volume of the whole ink cartridge is unnecessarily great.

On the other hand, in the construction of JP-A-108153/1983, the volume of the porous absorbent material before the absorption of the ink does not change because of the absorption of the ink, so that it is necessary to introduce into the cartridge from the beginning an amount of the porous absorbent material which is sufficient to absorb the whole quantity of the ink within the ink bag. Therefore, as with the case shown in Figure 4 in which the ink bag housing chamber G is provided separately from the waste ink housing chamber H, the total volume of the ink cartridge disclosed in JP-A-108153/1983 is unnecessarily large.

An object of the present invention is therefore to provide an ink cartridge whose size can be substantially reduced.

According, therefore, to one aspect of the present invention, there is provided an ink cartridge for an ink jet printer, the ink cartridge having a chamber therein within which is housed an ink bag containing ink, the chamber having absorbent material therein for absorbing waste ink characterised in that a waste ink bag is disposed within the said chamber, the waste ink bag containing the said absorbent material.

Preferably, the absorbent material is polymeric absorbent material. Thus the polymeric absorbent material may be selected from among a starch-based acrylic acid graft polymerization product, a polyacrylic acid salt-based polymer, a vinyl

alcohol-acrylic acid salt-based polymer, a PVA-based polymer and an isobutylene-maleic anhydride polymer.

The absorbent material may be dispersed in a non-woven fabric.

Preferably, the amount of absorbent material within the waste ink bag is sufficient to absorb the whole of the ink in the ink bag.

The waste ink bag is preferably provided with an air outlet.

According to another aspect of the present invention, there is provided an ink cartridge for an ink jet printer, the ink cartridge having therein both an ink bag containing ink and absorbent material for absorbing waste ink characterised in that the absorbent material is polymeric absorbent material.

The invention also comprises an ink jet printer provided with an ink cartridge as set forth above, the ink cartridge being connected by a first conduit to a printing head of the printer so as to supply ink to a nozzle or nozzles of the printing head, the printer having a cap which may be sealed to the said head so as to surround the nozzle or nozzles, and a second conduit including a pump by means of which the interior of the cap communicates with the interior of the waste ink bag, the pump being operable to withdraw ink from the cap and introduce it into the waste ink bag.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a cross-sectional view of a first embodiment of an ink cartridge for an ink jet printer according to the present invention;

Figure 2 is a plan view of a second embodiment of an ink cartridge for an ink jet printer according to the present invention;

Figure 3 is a cross-sectional view of the ink cartridge shown in Figure 2;

Figure 4 is a cross-sectional view of a known ink cartridge for an ink jet printer, and

Figure 5 is a diagrammatic view of a part of an ink jet printer provided with an ink cartridge according to the present invention.

In Figure 1 there is shown an ink cartridge 20 for an ink jet printer according to the present invention. The ink cartridge 20 comprises a cartridge case 10 having a chamber C therein within which is housed an ink bag 1 containing ink and a waste ink bag 3. The ink bag 1 communicates with an outlet port 1a which is welded to the ink bag 1 by heat sealing. The ink bag 1 is fixed directly to the cartridge case 10 by means of an adhesive or is fixed thereto by means of a pressure sensitive adhesive double coated tape. The outlet port 1a is also fixed to the cartridge case 10.

The waste ink bag 3, which is formed from a sheet material such as a film, is fixed to an upper wall 11 of the ink cartridge 20 at a portion A thereof by heat sealing, or by means of pressure sensitive adhesive double coated tape. Alternatively, the waste ink bag 3 may be riveted to the inner surface of the wall 11, e.g. by a "hot caulking" process in which the ink bag 3 is made of a thermoplastic material having at least one projection which has been passed freely through a hole in the wall 11, the end of the projection having been increased in size and pressed against the outer surface of the wall 11 by a heater. As a result of the heating, moreover, the projection is expanded so as to fill the hole.

A waste ink inlet port 3a is welded to the waste ink bag 3 by heat sealing and is also fixed to the cartridge case 10.

A polymeric absorbent material 4 for absorbing waste ink is disposed within the waste ink bag 3. Specific examples of the polymeric absorbent material 4 include a starch-based acrylic acid graft polymerization product (e.g. Sanwet manufactured by Sanyo Chemical Industry Ltd., WAS manufactured by Nippon Starch Chemical Co., Ltd. and Jell Fine manufactured by Daicel Chemical Industries, Ltd.); a polyacrylic acid salt-based polymer (e.g. Aqua Keep manufactured by Seitetsu Kagaku Co. Ltd., Aqualick CA manufactured by Nippon Shokubai Kagaku Kogyo Co. Ltd., Krisper manufactured by Arakawa Chemical Industries, Ltd., Turfine manufactured by Kao Corp. and Exlana manufactured by Nippon Exlan Corp.); a vinyl alcohol acrylic acid salt-based polymer (e.g. Sumika Gel manufactured by Sumitomo Chemical Co. Ltd.); a PVA-based polymer (e.g. GP manufactured by Nippon Synthetic Chemical Industry Co., Ltd.); and an isobutylene-maleic anhydride-based polymer (e.g. KI gel manufactured by Kuraray Isoprene Chemical Co. Ltd.). At least one of the above-mentioned materials is used as the polymeric absorbent material 4.

The polymeric absorbent material 4 has a weight (e.g. 1 to 10 g) sufficient to absorb the whole quantity of the ink within the ink bag 1. Since the absorbent material 4 is expansible, the amount of polymeric absorbent material 4 in the waste ink bag 3 before the absorption of the waste ink may be as little as about 1/20 to 1/100 of the weight of the ink within the ink bag 1, whereby to save space.

Although some polymeric absorbent materials have poor rates of absorption of a strongly alkaline ink, use of a polymeric absorbent material 4 comprising a starch-based acrylic acid graft copolymerization product (such for example as Sanwet IM-300, IM-1000, IM-2200 and IM-5000G manufactured by Sanyo Chemical Industries Ltd.) ensures

that the polymeric absorbent material 4 has sufficient absorption even when the ink within the ink bag 1 is strongly alkaline.

An air release tube 5 is inserted into the waste ink bag 3. The distal end 5a of the tube 5 is well spaced from the waste ink inlet port 3a, while the proximal end B thereof extends externally of the waste ink bag 3. For this reason, the interior of the waste ink bag 3 is in communication with the outside through the end B which constitutes an air hole. Waste ink may pass as described below in relation to Figure 5 into the waste ink bag 3 through a waste ink tube 6. The waste ink contains air which would unnecessarily expand the waste ink bag 3 were it not for the air hole B. However, the provision of the air hole B enables air which has passed into the waste ink bag 3 to pass externally thereof.

If there is a possibility that ink will also flow out from the air hole B, the latter can be provided with a liquid repellent and with an air permeable membrane which is permeable only to air and is impermeable to a liquid.

The ink cartridge 20 having the above-described construction may be inserted into a cartridge holder (not shown) for use thereof. In operation, ink passes out from the outlet port 1a, and any waste ink may be recovered as described below in relation to Figure 5 so as to pass through the waste ink inlet port 3a. As the amount of the recovered waste ink increases, the waste ink bag 3 expands while the ink bag 1 shrinks.

In Figures 2 and 3 there are respectively shown a plan view and a cross-sectional view of a second embodiment of the present invention.

As shown in Figures 2 and 3, the polymeric absorbent material may be homogeneously dispersed in a non-woven fabric 40 which is sealed into a waste ink bag 30. The non-woven fabric 40 is provided with an air hole 41, and the waste ink bag 30 is provided with a waste ink bag air hole 30b. As shown in Figure 2, the waste ink bag air hole 30b and the air hole 41 are located at substantially the same position. Specifically, if L is the longitudinal dimension of the non-woven fabric 40 containing the polymeric absorbent material, the air hole 41 and the waste ink bag air hole 30b are located at a distance of substantially $2/3L$ from the side of the cartridge on which a waste ink inlet port 3a is provided. This disposition is selected because the area of the non-woven fabric 40 where the air hole 41 is disposed is the last at which the waste ink will pass into the non-woven fabric.

Thus, the waste ink is absorbed into the non-woven fabric 40 containing the polymeric absorbent material, which enables only air to flow out through the air hole 41.

The constructions shown in Figure 1 and in

Figures 2 and 3 enable a reduction in the size and cost of the ink cartridge to be effected in a very simple manner. Specifically, the provision of a polymeric absorbent material in a waste ink bag enables the whole of the ink within the ink bag to be absorbed by absorbent material having, for instance, a volume of a half to about 1/10th of that which would be necessary if porous material such as sponge were housed in the waste ink recovery section of the cartridge. Therefore, the provision of only a small amount of the polymeric absorbent material in the waste ink bag is necessary prior to use. If the waste ink bag requires a large volume, the waste ink bag expands during the reception of the waste ink. However, since the amount of the ink within the ink bag is reduced at the same time, it is possible to utilize the space which has been occupied by the ink bag. This enables a substantial reduction in the size of the ink cartridge to be effected, whereas it has previously been necessary to provide space for recovering the waste ink. Therefore, it is also possible to reduce the size of the whole printer. Further, even when an air hole is provided, one or more means may be provided for preventing the leakage of ink by providing a ventilation tube, and in some cases, by utilizing a water repellent and gas permeable membrane, or by utilizing the liquid holding power of the polymeric absorbent material itself.

In Figure 5 there is shown part of an ink jet printer provided with an ink cartridge 70 according to the present invention. The ink cartridge 70 has a chamber 71 therein within which is housed an ink bag 72 containing ink 73 and a waste ink bag 74 containing absorbent material 75 homogeneously dispersed in a non-woven fabric.

The interior of the ink bag 72 is arranged to communicate with a conduit 76 containing a filter 77, the conduit 76 communicating with a head damper or variable chamber 80 in a printing head 81 of the printer. The head damper 80 is arranged to supply ink when required to nozzles (not shown) in the printing head 81 so that, during printing, ink will be supplied by capillary action from the ink bag 72 to the nozzles and thence onto paper or other record medium (not shown).

The printer is provided with a cap which is movable (by means not shown) between an inoperative position shown in Figure 5 in which the cap 82 is spaced from the printing head 81 and an operative position (not shown) in which the cap 82 is hermetically sealed to a surface 83 of the printing head 81 so as to surround the nozzles.

A pump unit 84 is provided with a conduit 85 which communicates with the interior of the cap 82 and also communicates with the interior of the waste ink bag 74 by way of an ink reservoir 86 and a pump 87. The pump unit 84 also has an air

damper or variable chamber 90 which communicates with the interior of the cap 82 by way of a conduit 91. The air damper 90 has an air outlet passage 92 flow of air through which is controlled by a valve member 93 operable by a solenoid 94.

In operation, if the supply of ink to a nozzle is interrupted, e.g. because of nozzle clogging, nozzle drying, air bubble insertion into a nozzle and so on, the cap 82 is brought into hermetic sealing contact with the surface 83 of the printing head 81 and the pump 87 and solenoid 94 are operated so that ink is sucked from the printing head 81 into the waste ink bag 74.

Claims

1. An ink cartridge (20) for an ink jet printer, the ink cartridge (20) having a chamber (C) therein within which is housed an ink bag (1) containing ink, the chamber (C) having absorbent material (4) therein for absorbing waste ink characterised in that a waste ink bag (3) is disposed within the said chamber (C), the waste ink bag (3) containing the said absorbent material (4).

2. An ink cartridge as claimed in claim 1 characterised in that the absorbent material (4) is polymeric absorbent material.

3. An ink cartridge as claimed in claim 2 characterised in that the polymeric absorbent material is selected from among a starch-based acrylic acid graft polymerization product, a polyacrylic acid salt-based polymer, a vinyl alcohol-acrylic acid salt-based polymer, a PVA-based polymer and an isobutylene-maleic anhydride polymer.

4. An ink cartridge as claimed in any preceding claim characterised in that the absorbent material is dispersed in a non-woven fabric.

5. An ink cartridge as claimed in any preceding claim characterised in that the amount of absorbent material (4) within the waste ink bag (3) is sufficient to absorb the whole of the ink in the ink bag (1).

6. An ink cartridge as claimed in any preceding claim characterised in that the waste ink bag (3) is provided with an air outlet (B).

7. An ink cartridge (20) for an ink jet printer, the ink cartridge (20) having therein both an ink bag (1) containing ink and absorbent material (4) for absorbing waste ink characterised in that the absorbent material (4) is polymeric absorbent material.

8. An ink cartridge for an ink jet printer comprising:

an ink bag (1) composed of a sheet material and filled with an ink; and
a waste ink bag (3) for recovering the waste ink, said ink bag (1) and said waste ink bag (3) being housed within the same housing (10), said waste

ink bag (3) accommodating a polymeric absorber (4) therein.

9. An ink jet printer provided with an ink cartridge as claimed in any preceding claim characterised in that the ink cartridge (70) is connected by a first conduit (76) to a printing head (81) of the printer so as to supply ink to a nozzle or nozzles of the printing head (81), the printer having a cap (82) which may be sealed to the said head (81) so as to surround the nozzle or nozzles, and a second conduit (85) including a pump (87) by means of which the interior of the cap (82) communicates with the interior of the waste ink bag (74), the pump being operable to withdraw ink from the cap (82) and introduce it into the waste ink bag (74).

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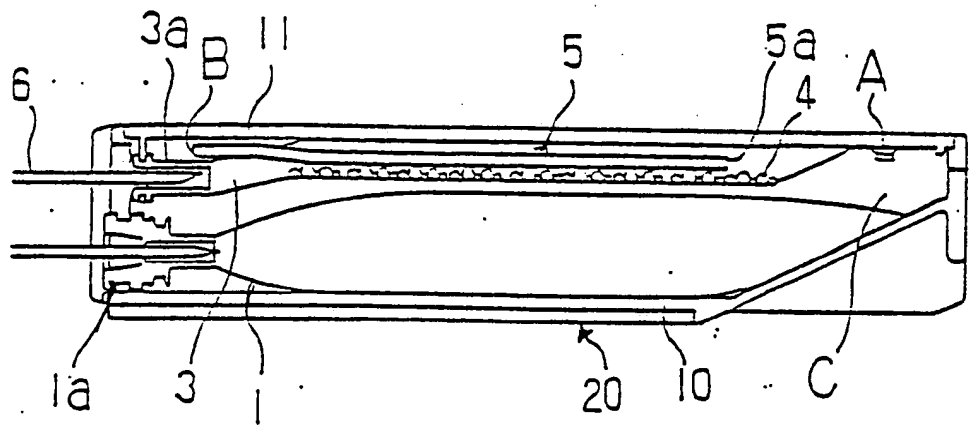


Fig. 1

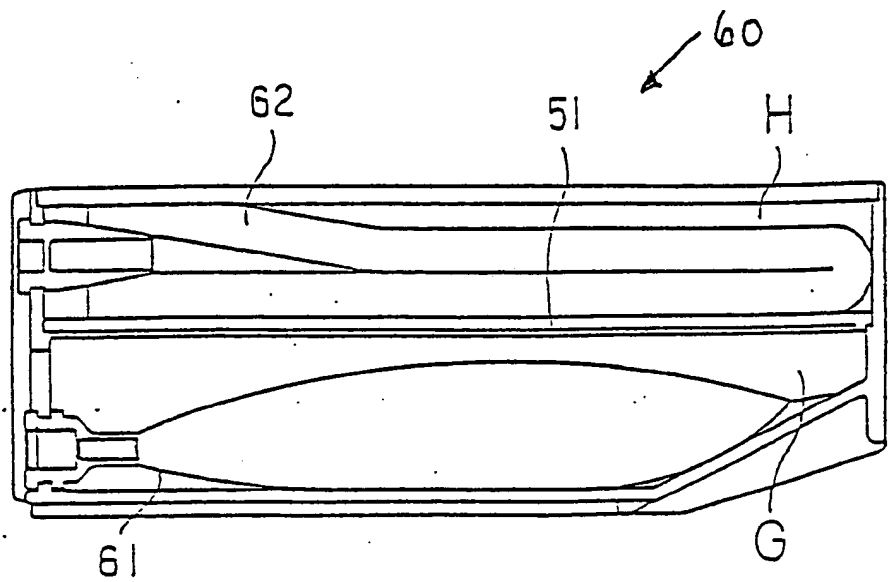


Fig. 4

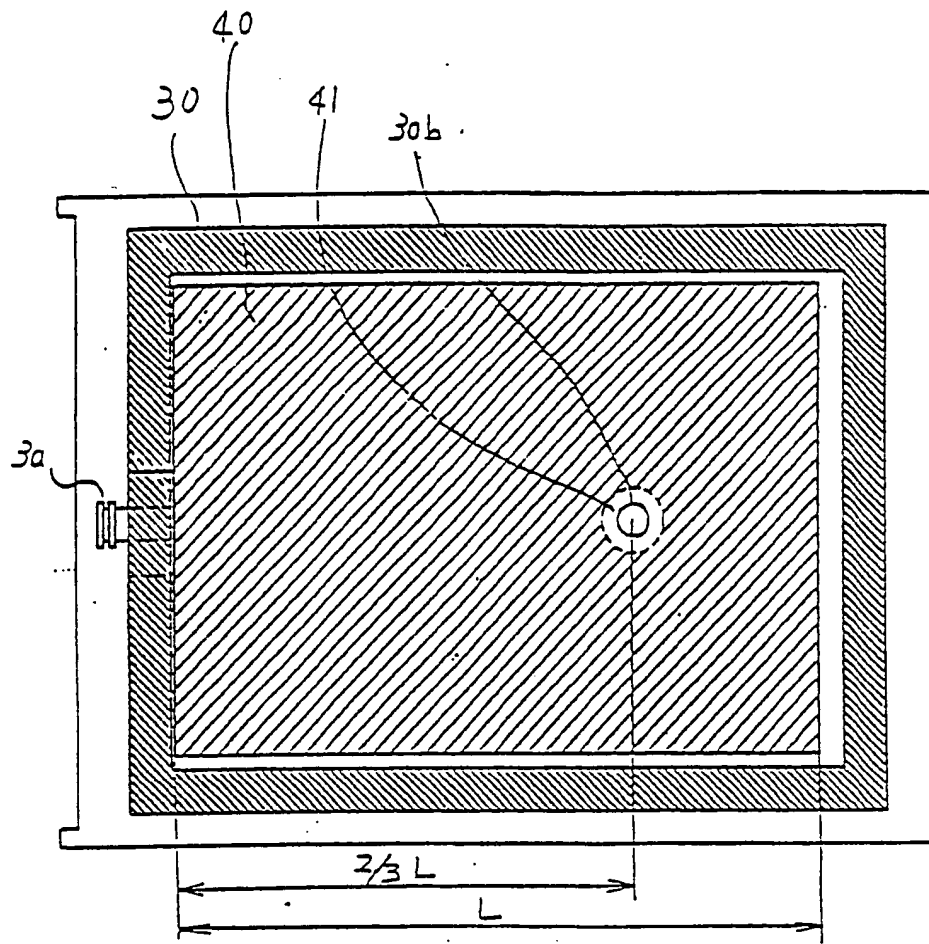


Fig. 2

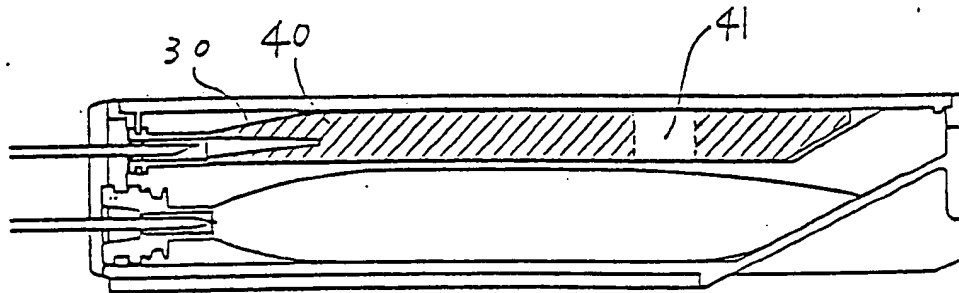


Fig. 3

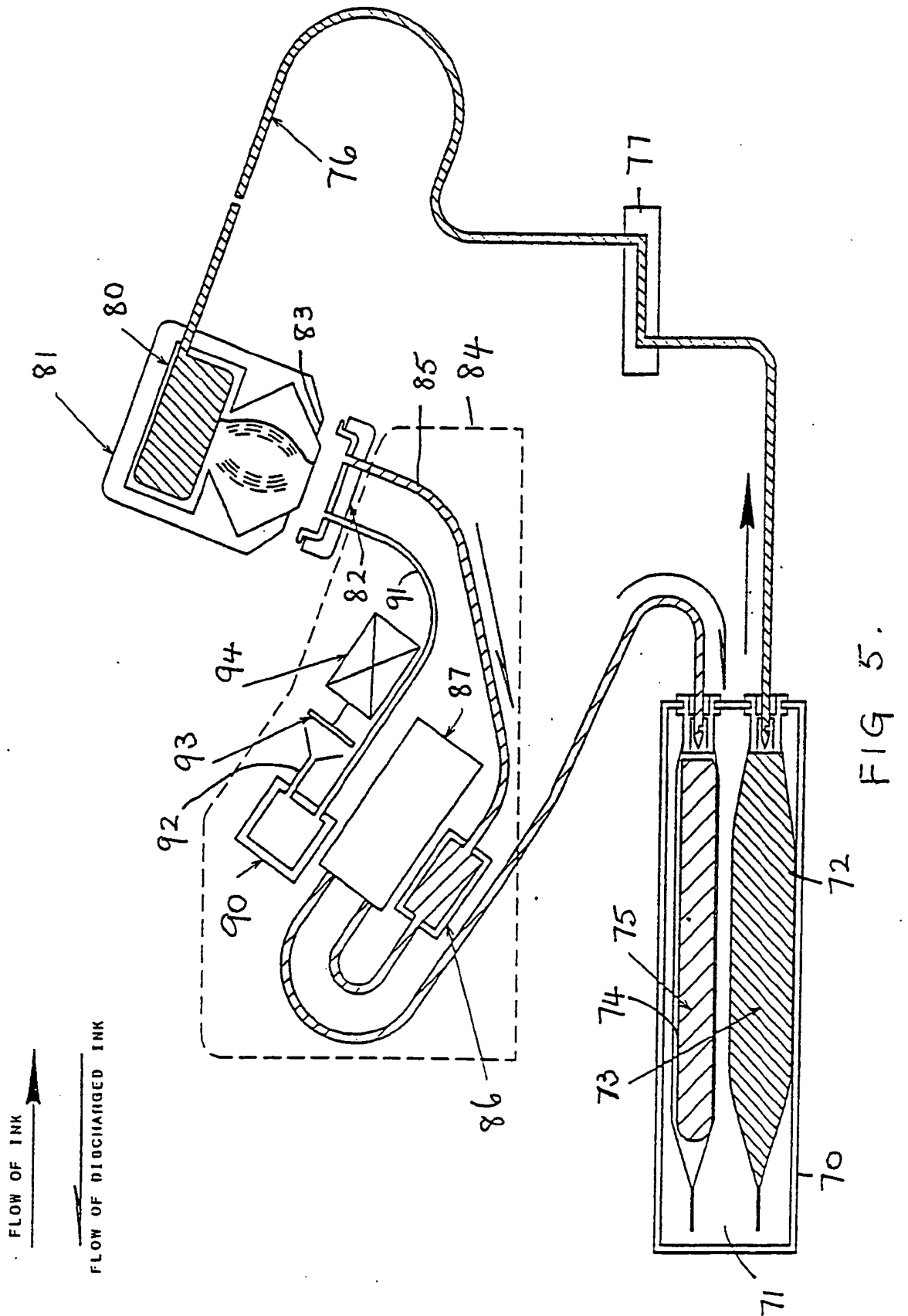


FIG 5.



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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,Y	PATENT ABSTRACTS OF JAPAN vol. 7, no. 215 (M-244)(1360), 22 September 1983; & JP-A-58108153 (EPUSON K.K.) 28.06.1983	1,2,5,8	B 41 J 2/175
A	idem ---	7	
Y	COMPUTER TECHNOLOGY REVIEW vol. 4, no. 4, 1984, pages 137-139, Los Angeles, California, US; L. PIETRASZKIEWICZ et al.: "Internal Cleaning Unit Resolves Traditional Ink-Jet Limitations" * figure 3 *	1,2,5,8	
P,X	DE-A-3 819 719 (SHARP K.K.) * abstract; column 6, lines 34-60; figures 3,5 *	1-3,5,7 ,8	
A	US-A-4 695 824 (S. TAZAKI) * column 2, line 52 - column 3, line 37; figures 1,2 *	1,5,7-9	
A	DE-A-3 612 299 (SHARP K.K.) * page 12, lines 10-24; figures 3,5 *	1-3,5,7 -9	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B 41 J 2/00
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The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 06-07-1990	Examiner DUCREAU F B
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